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AGRICULTURAL ELECTROTECHNICS.

M. PAUL RENAUP has recently contributed an extensive and valuable paper on applications, effected in Germany, of electrical engineering in the processes of agriculture, and remarks upon its future in France and her colonies.*

An earlier paper had been contributed by the same writer on the subject of agricultural electrical engineering, in which he had endeavored to exhibit the possibilities of such applications, and the present publication has permitted the review of progress to date in realizing earlier dreams and hopes. He proposes, later, to study the progress of this new art and applied science in the United States. In Germany the government has placed its own domains at the disposition of investigators and experimentalists, and the German Society of Agriculture has established exhibitions and competitions resulting in the general dissemination of knowledge thus acquired among its members and agriculturists generally.

In the production of this form of energy the wind has been availed of; the system of M. La Cour permitting the use of wind-mills by insuring a satisfactory system of regulation of mill and dynamo. Water-

ery of the fact that the oysters native to the north-west coast of the United States are hermaphrodite and viviparous. Specimens from the coast of Oregon and Washington show that the same conditions exist in the reproductive follicles as in those of *Ostrea edulis* of Europe. The presence of eggs and of spermato-blasts and spermatozoa in the same follicle is the invariable rule. The ova, like those of *O. edulis*, are much larger than those of *O. Virginica*, though perhaps not quite so large as the former. The embryos are fertilized in the gill and mantle cavities, where they undergo development."—Ed. SCIENCE.

* L'Électrotechnique agricole en Allemagne, son avenir en France and dans nos colonies; par M. Paul Renaud, ingénieur, ancien élève de l'École de Physique et Chimie industrielles de Paris; Bulletin de la Société d'Encouragement pour l'Industrie Nationale; Paris, Jan., 1899; p. 15.

power has become the principal source of power in this work in many sections of the country, and its regulation has also been made effective, in some cases, by Reiter's electric brake and governor, as constructed by the Reiter Co., at Winterthur (Switzerland). Like all hydraulic regulators, however, it is costly, its price being about \$400.

Recently the gas and petroleum motors are coming into use as prime motors for agricultural work of this character. They are considered to exhibit great advantages over the preceding forms. The use of producer gas ('*gaz pauvre*') is said to give the horse-power at about one-half the cost, in fuel, of the power of the steam-engine, and it requires far less careful or continuous supervision than the latter. Körting, of Körtingsdorf, has taken the lead in the introduction of this system. A double-cylinder gas-engine and direct-coupled generators are usually found most satisfactory. Costs decrease with increase in the proportion of time of operation, and the mean given corresponds to pretty nearly a variation as the fourth root of the annual time of working in hours.

The costs of transmission of the electric energy and of its application in ploughing, in the transportation of merchandise and in other farm operations, are stated as resulting from experience of the character indicated, and it is finally concluded:

1. The electric installation may be employed where a prime motor is already in place, as a steam-engine or a water-wheel, for the purpose of transmitting that energy to the point at which it is proposed, for a time, to perform work, as of operating the plough, centrifugal pumps, etc., in the field, and the various apparatus of the farm, within and without the buildings.

2. The electric plant may be installed at any point found convenient or desirable, as it can be arranged to supply the required power at any point, near or far, over a small

copper wire at little cost in time, trouble or money.

3. The same motor may be employed for various purposes, successively and at any time, with any forms of agricultural machinery; its small size and portability permitting its transport from one point to another with ease.

4. The facility with which the current may be divided and applied permits its use in driving a number of machines, of various forms, at the same time and in different places.

5. It allows the supply, at the same time, of power for machinery and for light and even for heat.

6. It affords safety against fire, where properly established, and heat, light and power may be thus furnished at minimum risk.

7. The manipulation of the apparatus is simple and easy.

8. This system permits the instantaneous operation of fire-pumps to confine and arrest an incipient fire; it being provided with a suitable system of distributing water mains.

9. By use in prompt suppression of epidemics, by destroying the first cases, extensive contagion and resultant dangers and sacrifices of life and property are avoided.

It is thought that the great sub-division of agricultural lands in France will prevent the introduction of such systems as rapidly as is desirable for the purpose of successfully competing with adjacent countries of Europe. But it remains for the electricians and engineers to secure capital, to distribute electrical energy at low costs, to rent out apparatus and even to see it properly manipulated by furnishing expert operatives, in order that the peasant may not be called upon to provide capital which it is almost impossible for him to find. The agriculturists must combine, form syndicates, and thus make powerful that energy

which is powerless in single and separated elements. The great proprietor will find it to his advantage to lead in the introduction of the new systems; setting an example to his neighbors that may later prove fruitful of great good.

In the colonies, it is stated, a spirit of threatening democracy is likely to make them, for a long time, comparatively unproductive, and even the legislators are not always without blame. "They go to their constituents with a cry against machinery which has always been most vehemently raised among these classes, especially against the introduction of machinery for hand-work." The fact is, of course, precisely the opposite, and the introduction of machinery has always benefited the workmen more than other classes. "Augmenting the returns to the proprietor, they permit him to raise the wages of those who continue to work on the soil."

R. H. THURSTON.

SCIENTIFIC BOOKS.

Geology of the Edwards Plateau and Rio Grande Plain adjacent to Austin and San Antonio, Texas, with Reference to the Occurrence of Underground Waters. By ROBERT T. HILL and T. WAYLAND VAUGHAN. From the Eighteenth Annual Report of the United States Geological Survey, 1896-97, Part II.—Papers Chiefly of a Theoretic Nature, pp. 193-321; pl. xxi.-lxiv. Washington, Government Printing Office. 1898.

This is, without doubt, one of the most important contributions to Texas geology in recent years. While the purpose of the authors is primarily to deal with the artesian water problem, they have in reality done much more, as is at once apparent by reference to their complete and detailed descriptions of the geology of this region.

"The artesian wells of the eastern half of Texas belong to several distinct systems, the term 'system' including all wells having their source in the same set of rock sheets or strata. * * * In the Cretaceous formations